M Probability

M1

Understand and use mutually exclusive and independent events when calculating probabilities.

Link to discrete and continuous distributions.

Students should be able to:

- find the probability of an event by extracting relevant information from a description of a situation (in context) or from a table of information
- recognise and use set theory notation in the context of probability, eg $\mathrm{P}(A \cup B)$, $\mathrm{P}(A \cap B)$, $\mathrm{P}(A')$
- recognise and define the meaning of mutually exclusive events, i.e. $\mathrm{P}(A \cap B) = 0$
- understand that $A \cup B$ means A or B and that, in probability, "or" is interpreted as an inclusive or, not as an exclusive or
- define the condition for two events to be independent and determine whether two events are independent by finding, and comparing, relevant probabilities, eg $\mathrm{P}(A \cap B) = \mathrm{P}(A) \times \mathrm{P}(B)$ or $\mathrm{P}(A) = \mathrm{P}(A \mid B)$, when the events A and B are independent (not required at AS).

10.1 Probability

Laws of Probability

Mutually Exclusive Events:

Events which have **no outcomes** in common **can't happen** at the same time. These events are called **mutually exclusive**. For example, you cannot roll a 6 and an odd number at the same time on a dice.

If A and B are mutually exclusive then P(A B) = 0
A Venn diagram would show non-overlapping circles.

10.1 Probability

Example 1a

A fair six sixed dice is rolled once. In each case, state whether the two events are mutually exclusive, and write down the value of P(A), P(B) and P(A or B).

a) A: rolling a 5; B: rolling a 6
b) A: rolling an even number; B: rolling a prime number

ing a 5 and rolling a 6 are mutually exclusive.

10.1 Probability

Example 1b

A fair six sixed dice is rolled once. In each case, state whether the two events are mutually exclusive, and write down the value of P(A), P(B) and P(A or B).

a) A: rolling a 5; B: rolling a 6
b) A: rolling an even number; B: rolling a prime number

an even prime so these are not mutually exclusive.

10.1 Probability

Example 2

A card is selected at random from a standard pack of 52 cards. Find the probability that the card is either a picture card (a Jack, Queen or King), or the 7, 8 or 9 of clubs.

Let A be the event ‘select a picture card’.
Let B be the event ‘select the 7, 8 or 9 of clubs’.

We want P(A B). The card cannot be both so A and B are mutually exclusive therefore P(A B) = P(A) + P(B).

10.1 Probability

Example 3

For two events, A and B, P(A) = 0.38, P(B) = 0.24 and
P(A B) = 0.6. Show whether or not events A and B are mutually exclusive.

Mutually exclusive when P(A B) = 0...

Addition law: P(A B) = P(A) + P(B) – P(A B)

0.6 = 0.38 + 0.24 – P(A B)

P(A B) = 0.38 + 0.24 – 0.6

P(A B) = 0.02

So P(A B) ≠ 0 therefore A and B are NOT

10.1 Probability

Example 4

For two events, A and B, P(A) = 0.75, and P(A B’) = 0.75. Show whether or not events A and B are mutually exclusive.

Remember, P(A) is made up of P(A B) and P(A B’)

P(A) = P(A B) + P(A B’)
0.75 = P(A B) + 0.75

So, P(A B) = 0 therefore A and B ARE mutually exclusive.

Exercise 3.2 from sheet